Chapter 1
Introduction

1-1. Purpose

This manual provides technical guidance for performing hydrographic surveys that support the planning, engineering design, construction, operation, maintenance, and regulation of navigation, flood control, river engineering, charting, and coastal engineering projects. Accuracy standards and quality control criteria are defined to establish US Army Corps of Engineers (USACE)-wide uniformity in performing surveys involving dredging measurement, payment, and acceptance.

1-2. Applicability

This manual applies to all USACE commands having responsibility for performing, contracting, or monitoring hydrographic surveys in support of the Corps civil works activities.

1-3. Distribution

This publication is approved for public release; distribution is unlimited.

1-4. References and Bibliography

Referenced USACE publications are listed at Appendix A. Where applicable, bibliographic information is listed at the end of each chapter.

1-5. Use of Manual

This manual shall be used as a technical guide in performing hydrographic surveys with USACE hired-labor forces or contracted survey forces. It should be directly referenced in contract specifications for dredging or Architect-Engineer survey services. The accuracy standards and quality control criteria in the manual shall be specified for all surveys supporting dredging measurement, payment, and acceptance functions. This manual may be referenced should hydrographic surveying functions be required as part of a USACE military construction or environmental restoration activity. It is also applicable to surveys performed or procured by local interest groups under various cooperative or cost-sharing agreements.

1-6. Background

The original version of this manual was published in 1991 and was revised in 1994. Most of the standards and technical guidance in the 1991 and 1994 versions were designed to support older analog depth recording instruments, mechanical, visual, or microwave positioning, and manual data processing and drafting methods. Since the last update, significant advances in hydrographic surveying technology have occurred. These include replacement of short-range microwave positioning techniques with local and nationwide Differential Global Positioning System (DGPS) systems, enhanced applications of and expanded use of full-bottom coverage acoustic multibeam systems, airborne LIDAR hydrographic survey systems, and functional use of carrier phase DGPS for accurate water surface determination. Field-finish data collection equipment and software has also become more robust, allowing for near-final data editing and processing on board the survey boat. Data accuracies have been enhanced through use of inertial and DGPS vessel motion sensors. Automated data editing, processing, transfer, and Internet display methods have also evolved considerably since 1994. In addition, the International Hydrographic Organization (IHO) and the Federal Geographic Data Committee (FGDC) have promulgated updated hydrographic survey accuracy

standards, statistical measures, and reporting standards. The accuracy standards in this manual were revised to more closely conform to these international and Federal standards. Older survey classifications (i.e., Contract Payment, Project Condition, and Reconnaissance) were originally developed to reflect accuracy limitations in manual and microwave positioning equipment. DGPS positioning has largely eliminated these distinctions; thus survey classifications have been modified accordingly. The manual now contains separate chapters that detail current procedures for dredging surveys, river engineering and charting surveys, airborne LIDAR surveys, and coastal engineering surveys. The chapter on contracted surveys has been expanded to reflect the increasing use of Architect-Engineer service contracts for hydrographic surveying.

1-7. Mandatory Requirements

ER 1110-2-1150 (Engineering and Design for Civil Works Projects) prescribes that mandatory requirements be identified in engineer manuals. Mandatory requirements in this manual are summarized at the end of each chapter. Mandatory accuracy standards, quality control, and quality assurance criteria are summarized in tables within each chapter. The mandatory criteria contained in this manual are based on the following considerations: (1) assurance of navigation safety, (2) essential to navigation project function, (3) previous Corps experience and practice has demonstrated criteria are critical, (4) Corps-wide geospatial data standardization requirements, (5) adverse economic impacts if criteria are not followed, and (6) HQUSACE commitments to the dredging industry.

a. Previous versions of this manual contained more rigid prescriptive criteria for performing all aspects of hydrographic surveys, including mandatory plant and survey instrumentation, equipment calibration procedures, accuracy standards, data collection procedures, and data plotting criteria. This updated version of the manual now limits mandatory requirements to those dealing with resultant accuracy standards and selected quality control and quality assurance criteria. This change more closely conforms to USACE policy emphasizing performance-based specifications--and recognizes the fact that technical procedures, equipment, and operating specifications are now evolving at a rapid pace.

b. Equipment calibration, operation, and procedural methods for performing and processing automated field hydrographic surveys are now usually detailed in operation manuals provided by the various equipment and software vendors. References and recommendations in this manual to specific operational methods must be carefully weighed against newly evolving technology and the latest manufacturer's recommendations.

c. Other Corps regulations may dictate mandatory requirements for processing, displaying, transferring, and archiving hydrographic survey data. These mandatory regulations will be referenced in each chapter when applicable. As survey technology and procedures develop, districts are strongly encouraged to recommend modifications to all mandatory criteria or technical guidance contained in this manual--see Proponency and Waivers section at the end of this chapter.

1-8. Scope of Manual

This manual covers all aspects of hydrographic surveying performed to support USACE river and harbor navigation activities, flood control projects, and coastal engineering projects. Special emphasis is placed on surveys that support construction/dredging of coastal and inland waterway projects. An overview of these support functions is covered in Chapter 2. The manual focuses on the preparation of design drawings and other documents associated with these projects, including related contracted construction performance activities. Throughout the manual, mandatory or recommended hydrographic survey criteria are normally summarized in tables. Technical or procedural guidance is in more general terms where methodologies are described in readily available references or survey instrumentation operating manuals. Numerous references are made to those more detailed operation manuals. Where procedural guidance is otherwise unavailable

from industry sources, it is provided herein. This primarily applies to older manual survey methods--e.g., mechanical tag line surveys.

a. Accuracy standards for USACE hydrographic surveys are provided in Chapter 3. These standards, together with quality control and quality assurance criteria, are presented for various Corps project applications.

b. General project planning criteria are covered in Chapters 3 through 6. Hydrographic positioning techniques are described in Chapter 7. Portions of Chapters 7 and 8 also cover older manual or visual survey techniques. Although these older methods have been made nearly obsolete by acoustic and GPS technology, occasional applications on Corps projects justify retention of the procedures for performing visual and mechanical surveys. The various procedures and systems for acoustic depth measurement are covered in Chapters 9 through 12 and Chapter 21. Cost estimating is covered under contracted survey topics in Chapter 22. The remainder of the chapters (13 through 20) cover specific civil works project applications.

1-9. Metrics

The use of both metric and English systems of measurement in this manual is predicated on the common use of both systems in engineering practice, and the exclusive use of English units by the navigation industry. Although most, if not all, electronic surveying and satellite measurement systems now acquire data in metric units, these data are readily converted to English units by processing software. In the Corps, water depths are typically expressed in feet and accuracy standards are expressed in feet. Distances are measured in either meters or feet; however, accuracy standards are expressed in meters. Engineering project coordinates are normally in English units (feet). Construction measurement quantities are normally measured in linear feet, square feet, or cubic yards; however some recent construction plans and specifications are using metric units of measure. Due to the variety of mixed measurements, equivalent conversions are not shown in this manual; the most common measurement unit is used for example computations. In all cases, metric conversions are based exclusively on the US Survey Foot, which equals *exactly* 1200/3937 m (or 3.280833333333 ft/m).

1-10. Brand Names

The citation in this report of brand names of commercially available products or software systems does not constitute official endorsement or approval of the use of such products.

1-11. Definitions

An explanation of hydrographic surveying terms and acronyms used in this manual is contained in the Glossary. Acronyms that are defined in the Glossary may not be spelled out in each chapter.

1-12. Proponency and Waivers

The overall HQUSACE proponent for this manual is the Engineering and Construction Division, Directorate of Civil Works. Technical development and compilation of the manual was coordinated by the US Army Topographic Engineering Center (CEERD-TS-G). Comments, recommended changes, or waivers to this manual should be forwarded through MSC to HQUSACE (ATTN: CECW-EE). Technical issues or waivers dealing specifically with dredging operations shall be forwarded through MSC to HQUSACE (ATTN: CECW-OD).